AF

PATENT
00-S-023

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:)	
CHARLES F. NEUGEBAUER)	Group Art Unit: 2628
Serial No.: 09/536,880)	
Confirmation No.: 3367)	Examiner: J. Brier
Filed: March 27, 2000)	
For: CONTEXT SENSITIVE SCALING)	
CIRCUIT AND METHOD)	

APPELLANT'S REPLY BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Examiner's Answer dated January 17, 2007, the due date for response to which is March 19, 2007 (the first business day after March 17, 2007), Appellant hereby respectfully submits his reply brief in support of his appeal to the Board of Patent Appeals and Interferences of the Examiner's final rejection of claims 3, 5-10, 12-16, 18-22, 24, and 25 of the above-referenced application.

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on 3/19/07.
Date of Deposit

Stephen Bongini
Applicant, Assignee, or Representative

/Stephen Bongini/
Signature

RESPONSE TO EXAMINER'S ARGUMENTS

THE INDEPENDENT CLAIMS ARE PATENTABLE OVER LIN

The Examiner has taken the position that Lin (U.S. Patent No. 6,044,178) discloses a method and an image scaling device for scaling a source image to produce a scaled destination image in which a pixel of the scaled destination image is generated by using a convolution kernel that is generated from a plurality of available convolution kernels based on a local context metric, with the available convolution kernels including at least one smoothing kernel and at least one sharpening kernel. [Examiner's Answer at 3-4, 6-7, 12-15] This position of the Examiner is respectfully traversed.

The pending independent claims recite methods and devices for scaling a source image in which a pixel of the scaled destination image is generated by using a convolution kernel that is generated from a plurality of available convolution kernels that include at least one smoothing kernel and at least one sharpening kernel. Thus, the claims require at least one smoothing kernel and at least one sharpening kernel. In contrast, Lin discloses using multiple filter units that are all smoothing filters. In particular, Lin teaches using "low pass filter 78" and "low pass filter 86" that each implement a "gaussian filter" with kernel coefficients of "1/15, 3/15, 7/15, 3/15, 1/15", and "low pass filter 72" that implements "a gaussian filter" with kernel coefficients of "1/10, 1/5, 2/5, 1/5, 1/10". See Lin at 6:18-22, 6:33-37, 6:55-58. Thus, Lin only discloses scaling an image using low pass filters that use gaussian smoothing kernels. Nowhere does Lin teach or suggest a method or device for scaling an image using a filter that uses a sharpening kernel.

While Lin specifically teaches scaling an image using three low pass filters that use gaussian smoothing kernels, the Examiner's has taken the position that two of the three filters of Lin are, contrary to the teaching of Lin, actually high pass filters that use a sharpening kernel. The Examiner's position is that "Lin does use the words low pass filter when referring to filters 78 and 86, however, the coefficients [of these filters] imply a high pass filter" [Examiner's Answer at 12] Because all of the Examiner's rejections are based on this position, if the

Examiner is incorrect in his assertion that the coefficients of filters 78 and 86 of Lin define a high pass filter using a sharpening kernel then all of the Examiner's rejections are improper and should be reversed. The Examiner is incorrect for at least the following reasons.

First, the Examiner states that the coefficients of filters 78 and 86 of Lin define a high pass filter because a "high pass filter passes more of the center pixel's value than does a low pass filter." However, this is not how high pass and low pass filters, or sharpening and smoothing filters, are actually defined.

A "low pass filter" is the basis for most smoothing methods. An image is smoothed by decreasing the disparity between pixel values by averaging nearby pixels. Using a low pass filter tends to retain the low frequency information within an image while reducing the high frequency information. An example of a low pass filter is an array of ones divided by the number of elements within the kernel, such as a 3 by 3 kernel with "1/9" at all positions. However, this is only an example of one possible kernel for a low pass filter, and other low pass filters may include more weighting for the center point, or have different smoothing in each dimension. See NASA's IDL Astronomy Library, Image Processing in IDL Online Help (March 01, 2006).[1]

In contrast, a "high pass filter" is the basis for most sharpening methods. An image is sharpened when contrast is enhanced between adjoining areas with little variation in brightness or darkness. A high pass filter tends to retain the high frequency information within an image while reducing the low frequency information. The kernel of the high pass filter is designed to increase the brightness of the center pixel relative to neighboring pixels. The kernel array usually contains a single positive value at its center, which is completely surrounded by negative values. An example of a high pass filter is a 3 by 3 kernel with 8/9 at the center surrounded by -1/9 at all of the other positions. However, this is only an example of one possible kernel for a high pass filter, and other high pass filters may include more weighting for the center point. See Id.

[1] Available at: http://idlastro.gsfc.nasa.gov/idl_html_help/Filtering_an_Imageiry.html

Thus, two low pass filters, and similarly two high pass filters, can weigh the center pixel differently. Accordingly, the Examiner's position that filters 78 and 86 of Lin define a high pass filter simply because they pass more of the center pixel's value than filter 72 of Lin is incorrect.

Second, all of the filter coefficients disclosed in Lin define smoothing kernels that operate to smooth an image. The Examiner is incorrect, regardless of his reasoning, in labeling one of the disclosed sets of filter coefficients as a sharpening kernel.

As explained above, an image is smoothed by decreasing the disparity between pixel values by averaging nearby pixels, while an image is sharpened when contrast is enhanced between adjoining areas with little variation in brightness or darkness by increasing the brightness of the center pixel relative to neighboring pixels. See Id.

In more detail, low-pass filters smooth out sharp transitions in gray levels and remove noise. Three exemplary low-pass filter convolution kernels are shown below.

0	1/6	0		1/10	1/10	1/10		1/16	1/8	1/16
1/6	1/3	1/6		1/10	1/5	1/10		1/8	1/4	1/8
0	1/6	0		1/10	1/10	1/10		1/16	1/8	1/16

Each of these smoothing kernels has the same general form for replacing the center pixel with the average of the area, with a "peak" in the center. All of these kernels smooth an image by making transitions look fuzzy, blurred, or washed out. See Dwayne Phillips, "Image Processing, Part 7: Spatial Frequency Filtering," The C Users Journal (January, 1992).[2]

In contrast, high-pass filters amplify or enhance a sharp transition (i.e., an edge) in the image. Three exemplary high-pass filter convolution kernels are shown below.

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[2] Available at: http://www.tcnj.edu/~hernande/cujv5/html/10.10/phillip1/phillip1.htm

0	-1	0		-1	-1	-1		1	-2	1
-1	5	-1		-1	9	-1		-2	5	-2
0	-1	0		-1	-1	-1		1	-2	1

Each of these sharpening kernels has the same form of a peak in the center, negative values above, below, and to the sides of the center, and corner values near zero. While the different values produce different amplifications for different high frequencies in the image, all of these kernels sharpen an image by enhancing edges and detail. See Id.

Filters 78 and 86 of Lin each have kernel coefficients of "1/15, 3/15, 7/15, 3/15, 1/15", and filter 72 of Lin has kernel coefficients of "1/10, 1/5, 2/5, 1/5, 1/10". Clearly both of these sets of coefficients average nearby pixels so as to smooth an image. While one set of coefficients more heavily weights the center pixel relative to its neighbors, this is just a question of degree. Both sets of coefficients replace the center pixel with the average of the area with a "peak" in the center, so as to smooth the image by blurring transitions. Neither of these sets of coefficients will sharpen an image (i.e., enhance edges and detail) because neither increases the brightness of the center pixel relative to neighboring pixels. Instead, both smooth an image by making the center pixel more like its neighbors through averaging.

Thus, all of the filter coefficients disclosed in Lin define smoothing kernels that operate to smooth an image. Accordingly, the Examiner's position that the coefficients disclosed for filters 78 and 86 of Lin define a sharpening kernel is incorrect.

Third, the Examiner asserts that filters 78 and 86 of Lin define a high pass filter based on Lin's statement that the coefficients of filter 78 "help to maintain the higher-frequency attributes of the text." [Examiner's Answer at 13] The Examiner goes on to state that the kernel used in filters 78 and 86 of Lin is a sharpening kernel because, based on this statement of Lin, this kernel "maintains sharpness during the scaling" and its "purpose is to maintain the higher-frequency attributes of the text." [Examiner's Answer at 13-14] However, this misinterprets Lin's

statement and the conclusions drawn by the Examiner are contrary to how high pass and low pass filters, or sharpening and smoothing filters, are actually defined.

Lin's statement that the coefficients of filter 78 "help to maintain the higher-frequency attributes" in the image is much different than saying that the filter is a high pass filter (or more importantly that the filter sharpens the image). As explained above and in Appellant's Brief, <u>two kernels with different coefficients are both "smoothing kernels" if each of the kernels operates to smooth the image by averaging nearby pixels, which tends to retain the low frequency information while reducing the high frequency information (or sharpness).</u> Both sets of filter coefficients used in Lin average nearby pixels and operate to smooth the image. However, one filter will smooth the image less than the other filter. Because smoothing causes the loss of higher-frequency attributes (or sharpness) of the image, the filter of Lin that smooths the image less will "help to maintain the higher-frequency attributes" (or "maintain sharpness") as compared to the other filter. Thus, Lin's statement that the coefficients of filter 78 "help to maintain the higher-frequency attributes of the text" means that filter 78 smooths the image less than filter 72, not that filter 78 is a "high pass filter" or that filter 78 will "sharpen" the image.

This is analogous to two filters in the frequency domain: a first low pass filter that filters out frequencies above 100 Hz and a second low pass filter that filters out frequencies above 500 Hz. While both filters are "low pass filters" that filter out low frequency components of the signal, the second low pass filter will "maintain the higher-frequency attributes" of the signal (those between 100 Hz and 500 Hz) as compared to the first low pass filter. It would be incorrect to label the second filter as a "high pass filter"; both filters are still "low pass filters" but with different properties. In the same way, it is incorrect for the Examiner to label filter 78 as a "high pass filter" and its coefficients as defining a "sharpening kernel" just because these coefficients "help to maintain the higher-frequency attributes of the text" or "maintain sharpness".

Furthermore, Lin never actually states that "this kernel's purpose is to maintain the higher-frequency attributes of the text" as asserted by the Examiner. This statement was just made up by the Examiner. Lin only merely states that the coefficients of filter 78 "help to

maintain the higher-frequency attributes of the text" (which, as explained above, does not mean that filter 78 is a high pass filter or that it operates to sharpen the image).

All of the filter coefficients disclosed in Lin define smoothing kernels that operate to smooth the image. Accordingly, the Examiner's position that filters 78 and 86 of Lin define a high pass filter is incorrect.

Fourth, the Examiner's defining of one of the filters of Lin relative to the other filter of Lin is improper. Throughout the Examiner's Answer, the Examiner takes the position that any kernel that sharpens relative to a kernel that smooths is a sharpening kernel. Such an interpretation of the recited terms "smoothing kernel" and "sharpening kernel" is improper because it completely ignores the established meanings of these terms in the art, or at the least, how these terms are used in the present application.

The definitions of "smoothing kernel" and "sharpening kernel" have been explained in detail in Appellant's Brief. It is improper to identify one as a "smoothing kernel" and the other as a "sharpening kernel" just because one kernel smooths the image to a greater degree than the other smooths the image. As explained in Appellant's Brief, this is analogous to defining "positive" versus "negative" integers. The determination of whether an integer is "positive" or "negative" is made independently for each integer based on the value of the integer relative to zero. Given two integers that are both less than zero, it is improper to identify one as a "negative integer" and the other as a "positive integer" just because one integer is more negative than the other. Likewise, the Examiner is incorrect to identify any kernel that sharpens relative to a kernel that smooths as a sharpening kernel.

Further, <u>the Examiner asserts that the coefficients of filter 78 define a "sharpening kernel"</u> in the context of Lin when these coefficients are compared to the coefficients of filter 72. However, by using the Examiner's relative definitions for smoothing and sharpening kernels, then if filter 72 of Lin were to be altered to have coefficients of "1/15, 2/15, 9/15, 2/15, 1/15", <u>then under the Examiner's own definition the coefficients of filter 78 would define a "smoothing</u>

kernel" because they smooth more than the new coefficients for filter 72. The same kernel cannot possibly be defined as a "smoothing kernel" when used alongside kernel A and a "sharpening kernel" when used alongside kernel B.

This situation becomes even worse if the filters of Lin were to be altered such that filter 78 keeps the same kernel, filter 72 smooths more than filter 78, and filter 78 smooths more than filter 86. In such a situation, how would the Examiner's relative definition scheme operate when filter 78 smooths more than 86 but at the same time filter 78 sharpens more than filter 72? How would the coefficients of filter 78 be defined by the Examiner in this situation. While the coefficients of filter 78 would have the same effect on the image regardless of the other filters used in the system, the Examiner would define this same set of coefficients differently in different situations. Such defining of a kernel relative to other kernels in a system is incorrect and unworkable.

Appellant completely fails to understand why the Examiner continues to insist that one of the filters in the device of Lin is a high pass filter based on his own definition, when this goes against the actual teaching of Lin, goes against the effects that the filters would clearly produce, and goes against the well-known meanings of the terms "smoothing" and "sharpening". Both sets of coefficients used in Lin operate to smooth an image by making the target pixel more like its neighbors through averaging. While the two sets of coefficients used in Lin are different so as to smooth the image to different degrees, each is clearly operates to smooth the image and it is improper to define one as a "smoothing kernel" and the other as a "sharpening kernel". Lin teaches scaling all portions of the source image using low pass filters that use "smoothing convolution kernels" to smooth the image, and does not teach or suggest a method or device for scaling an image using a filter that uses a sharpening kernel. Therefore, the independent claims are patentable over the Lin reference.

THE DEPENDENT CLAIMS ARE PATENTABLE OVER LIN AND MIYAKE

As discussed above, the independent claims are patentable over the Lin reference. Furthermore, the claimed features of the present invention are not realized even if the teachings of the Miyake reference are incorporated into Lin. Miyake does not teach or suggest the claimed features of the present invention that are absent from Lin. Thus, the independent claims distinguish over the Lin and Miyake references, and thus, the dependent claims also distinguish over the Lin and Miyake references.

CONCLUSION

In view of the foregoing, it is respectfully submitted that the application and all of the pending claims are in condition for allowance. Reversal of the final rejection of claims 3, 5-10, 12-16, 18-22, 24, and 25 is respectfully requested.

Respectfully submitted,

Date: March 19, 2007

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The pending independent claims recite methods and devices for scaling a source image in which a pixel of the scaled destination image is generated by using a convolution kernel that is generated from a plurality of available convolution kernels that include at least one smoothing kernel and at least one sharpening kernel. Thus, the claims require at least one smoothing kernel and at least one sharpening kernel. In contrast, Lin discloses using multiple filter units that are all smoothing filters. In particular, Lin teaches using "low pass filter 78" and "low pass filter 86" that each implement a "gaussian filter" with kernel coefficients of "1/15, 3/15, 7/15, 3/15, 1/15", and "low pass filter 72" that implements "a gaussian filter" with kernel coefficients of "1/10, 1/5, 2/5, 1/5, 1/10". See Lin at 6:18-22, 6:33-37, 6:55-58. Thus, Lin only discloses scaling an image using low pass filters that use gaussian smoothing kernels. Nowhere does Lin teach or suggest a method or device for scaling an image using a filter that uses a sharpening kernel.

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Each of these smoothing kernels has the same general form for replacing the center pixel with the average of the area, with a "peak" in the center. All of these kernels smooth an image by making transitions look fuzzy, blurred, or washed out. See Dwayne Phillips, "Image Processing, Part 7: Spatial Frequency Filtering," The C Users Journal (January, 1992).[2]

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Thus, all of the filter coefficients disclosed in Lin define smoothing kernels that operate to smooth an image. Accordingly, the Examiner's position that the coefficients disclosed for filters 78 and 86 of Lin define a sharpening kernel is incorrect.

Third, the Examiner asserts that filters 78 and 86 of Lin define a high pass filter based on Lin's statement that the coefficients of filter 78 "help to maintain the higher-frequency attributes of the text." [Examiner's Answer at 13] The Examiner goes on to state that the kernel used in filters 78 and 86 of Lin is a sharpening kernel because, based on this statement of Lin, this kernel "maintains sharpness during the scaling" and its "purpose is to maintain the higher-frequency attributes of the text." [Examiner's Answer at 13-14] However, this misinterprets Lin's

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kernel" because they smooth more than the new coefficients for filter 72. The same kernel cannot possibly be defined as a "smoothing kernel" when used alongside kernel A and a "sharpening kernel" when used alongside kernel B.

This situation becomes even worse if the filters of Lin were to be altered such that filter 78 keeps the same kernel, filter 72 smooths more than filter 78, and filter 78 smooths more than filter 86. In such a situation, how would the Examiner's relative definition scheme operate when filter 78 smooths more than 86 but at the same time filter 78 sharpens more than filter 72? How would the coefficients of filter 78 be defined by the Examiner in this situation. While the coefficients of filter 78 would have the same effect on the image regardless of the other filters used in the system, the Examiner would define this same set of coefficients differently in different situations. Such defining of a kernel relative to other kernels in a system is incorrect and unworkable.

Appellant completely fails to understand why the Examiner continues to insist that one of the filters in the device of Lin is a high pass filter based on his own definition, when this goes against the actual teaching of Lin, goes against the effects that the filters would clearly produce, and goes against the well-known meanings of the terms "smoothing" and "sharpening". Both sets of coefficients used in Lin operate to smooth an image by making the target pixel more like its neighbors through averaging. While the two sets of coefficients used in Lin are different so as to smooth the image to different degrees, each is clearly operates to smooth the image and it is improper to define one as a "smoothing kernel" and the other as a "sharpening kernel". Lin teaches scaling all portions of the source image using low pass filters that use "smoothing convolution kernels" to smooth the image, and does not teach or suggest a method or device for scaling an image using a filter that uses a sharpening kernel. Therefore, the independent claims are patentable over the Lin reference.

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THE INDEPENDENT CLAIMS ARE PATENTABLE OVER LIN

The Examiner has taken the position that Lin (U.S. Patent No. 6,044,178) discloses a method and an image scaling device for scaling a source image to produce a scaled destination image in which a pixel of the scaled destination image is generated by using a convolution kernel that is generated from a plurality of available convolution kernels based on a local context metric, with the available convolution kernels including at least one smoothing kernel and at least one sharpening kernel. [Examiner's Answer at 3-4, 6-7, 12-15] This position of the Examiner is respectfully traversed.

The pending independent claims recite methods and devices for scaling a source image in which a pixel of the scaled destination image is generated by using a convolution kernel that is generated from a plurality of available convolution kernels that include at least one smoothing kernel and at least one sharpening kernel. Thus, the claims require at least one smoothing kernel and at least one sharpening kernel. In contrast, Lin discloses using multiple filter units that are all smoothing filters. In particular, Lin teaches using "low pass filter 78" and "low pass filter 86" that each implement a "gaussian filter" with kernel coefficients of "1/15, 3/15, 7/15, 3/15, 1/15", and "low pass filter 72" that implements "a gaussian filter" with kernel coefficients of "1/10, 1/5, 2/5, 1/5, 1/10". See Lin at 6:18-22, 6:33-37, 6:55-58. Thus, Lin only discloses scaling an image using low pass filters that use gaussian smoothing kernels. Nowhere does Lin teach or suggest a method or device for scaling an image using a filter that uses a sharpening kernel.

While Lin specifically teaches scaling an image using three low pass filters that use gaussian smoothing kernels, the Examiner's has taken the position that two of the three filters of Lin are, contrary to the teaching of Lin, actually high pass filters that use a sharpening kernel. The Examiner's position is that "Lin does use the words low pass filter when referring to filters 78 and 86, however, the coefficients [of these filters] imply a high pass filter" [Examiner's Answer at 12] Because all of the Examiner's rejections are based on this position, if the

Examiner is incorrect in his assertion that the coefficients of filters 78 and 86 of Lin define a high pass filter using a sharpening kernel then all of the Examiner's rejections are improper and should be reversed. The Examiner is incorrect for at least the following reasons.

First, the Examiner states that the coefficients of filters 78 and 86 of Lin define a high pass filter because a "high pass filter passes more of the center pixel's value than does a low pass filter." However, this is not how high pass and low pass filters, or sharpening and smoothing filters, are actually defined.

A "low pass filter" is the basis for most smoothing methods. An image is smoothed by decreasing the disparity between pixel values by averaging nearby pixels. Using a low pass filter tends to retain the low frequency information within an image while reducing the high frequency information. An example of a low pass filter is an array of ones divided by the number of elements within the kernel, such as a 3 by 3 kernel with "1/9" at all positions. However, this is only an example of one possible kernel for a low pass filter, and other low pass filters may include more weighting for the center point, or have different smoothing in each dimension. See NASA's IDL Astronomy Library, Image Processing in IDL Online Help (March 01, 2006).[1]

In contrast, a "high pass filter" is the basis for most sharpening methods. An image is sharpened when contrast is enhanced between adjoining areas with little variation in brightness or darkness. A high pass filter tends to retain the high frequency information within an image while reducing the low frequency information. The kernel of the high pass filter is designed to increase the brightness of the center pixel relative to neighboring pixels. The kernel array usually contains a single positive value at its center, which is completely surrounded by negative values. An example of a high pass filter is a 3 by 3 kernel with 8/9 at the center surrounded by -1/9 at all of the other positions. However, this is only an example of one possible kernel for a high pass filter, and other high pass filters may include more weighting for the center point. See Id.

[1] Available at: http://idlastro.gsfc.nasa.gov/idl_html_help/Filtering_an_Imageiry.html

Thus, two low pass filters, and similarly two high pass filters, can weigh the center pixel differently. Accordingly, the Examiner's position that filters 78 and 86 of Lin define a high pass filter simply because they pass more of the center pixel's value than filter 72 of Lin is incorrect.

Second, all of the filter coefficients disclosed in Lin define smoothing kernels that operate to smooth an image. The Examiner is incorrect, regardless of his reasoning, in labeling one of the disclosed sets of filter coefficients as a sharpening kernel.

As explained above, an image is smoothed by decreasing the disparity between pixel values by averaging nearby pixels, while an image is sharpened when contrast is enhanced between adjoining areas with little variation in brightness or darkness by increasing the brightness of the center pixel relative to neighboring pixels. See Id.

In more detail, low-pass filters smooth out sharp transitions in gray levels and remove noise. Three exemplary low-pass filter convolution kernels are shown below.

0	1/6	0		1/10	1/10	1/10		1/16	1/8	1/16
1/6	1/3	1/6		1/10	1/5	1/10		1/8	1/4	1/8
0	1/6	0		1/10	1/10	1/10		1/16	1/8	1/16

Each of these smoothing kernels has the same general form for replacing the center pixel with the average of the area, with a "peak" in the center. All of these kernels smooth an image by making transitions look fuzzy, blurred, or washed out. See Dwayne Phillips, "Image Processing, Part 7: Spatial Frequency Filtering," The C Users Journal (January, 1992).[2]

In contrast, high-pass filters amplify or enhance a sharp transition (i.e., an edge) in the image. Three exemplary high-pass filter convolution kernels are shown below.

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[2] Available at: http://www.tcnj.edu/~hernande/cujv5/html/10.10/phillip1/phillip1.htm

0	-1	0		-1	-1	-1		1	-2	1
-1	5	-1		-1	9	-1		-2	5	-2
0	-1	0		-1	-1	-1		1	-2	1

Each of these sharpening kernels has the same form of a peak in the center, negative values above, below, and to the sides of the center, and corner values near zero. While the different values produce different amplifications for different high frequencies in the image, all of these kernels sharpen an image by enhancing edges and detail. See Id.

Filters 78 and 86 of Lin each have kernel coefficients of "1/15, 3/15, 7/15, 3/15, 1/15", and filter 72 of Lin has kernel coefficients of "1/10, 1/5, 2/5, 1/5, 1/10". Clearly both of these sets of coefficients average nearby pixels so as to smooth an image. While one set of coefficients more heavily weights the center pixel relative to its neighbors, this is just a question of degree. Both sets of coefficients replace the center pixel with the average of the area with a "peak" in the center, so as to smooth the image by blurring transitions. Neither of these sets of coefficients will sharpen an image (i.e., enhance edges and detail) because neither increases the brightness of the center pixel relative to neighboring pixels. Instead, both smooth an image by making the center pixel more like its neighbors through averaging.

Thus, all of the filter coefficients disclosed in Lin define smoothing kernels that operate to smooth an image. Accordingly, the Examiner's position that the coefficients disclosed for filters 78 and 86 of Lin define a sharpening kernel is incorrect.

Third, the Examiner asserts that filters 78 and 86 of Lin define a high pass filter based on Lin's statement that the coefficients of filter 78 "help to maintain the higher-frequency attributes of the text." [Examiner's Answer at 13] The Examiner goes on to state that the kernel used in filters 78 and 86 of Lin is a sharpening kernel because, based on this statement of Lin, this kernel "maintains sharpness during the scaling" and its "purpose is to maintain the higher-frequency attributes of the text." [Examiner's Answer at 13-14] However, this misinterprets Lin's

statement and the conclusions drawn by the Examiner are contrary to how high pass and low pass filters, or sharpening and smoothing filters, are actually defined.

Lin's statement that the coefficients of filter 78 "help to maintain the higher-frequency attributes" in the image is much different than saying that the filter is a high pass filter (or more importantly that the filter sharpens the image). As explained above and in Appellant's Brief, two kernels with different coefficients are both "smoothing kernels" if each of the kernels operates to smooth the image by averaging nearby pixels, which tends to retain the low frequency information while reducing the high frequency information (or sharpness). Both sets of filter coefficients used in Lin average nearby pixels and operate to smooth the image. However, one filter will smooth the image less than the other filter. Because smoothing causes the loss of higher-frequency attributes (or sharpness) of the image, the filter of Lin that smooths the image less will "help to maintain the higher-frequency attributes" (or "maintain sharpness") as compared to the other filter. Thus, Lin's statement that the coefficients of filter 78 "help to maintain the higher-frequency attributes of the text" means that filter 78 smooths the image less than filter 72, not that filter 78 is a "high pass filter" or that filter 78 will "sharpen" the image.

This is analogous to two filters in the frequency domain: a first low pass filter that filters out frequencies above 100 Hz and a second low pass filter that filters out frequencies above 500 Hz. While both filters are "low pass filters" that filter out low frequency components of the signal, the second low pass filter will "maintain the higher-frequency attributes" of the signal (those between 100 Hz and 500 Hz) as compared to the first low pass filter. It would be incorrect to label the second filter as a "high pass filter"; both filters are still "low pass filters" but with different properties. In the same way, it is incorrect for the Examiner to label filter 78 as a "high pass filter" and its coefficients as defining a "sharpening kernel" just because these coefficients "help to maintain the higher-frequency attributes of the text" or "maintain sharpness".

Furthermore, Lin never actually states that "this kernel's purpose is to maintain the higher-frequency attributes of the text" as asserted by the Examiner. This statement was just made up by the Examiner. Lin only merely states that the coefficients of filter 78 "help to

maintain the higher-frequency attributes of the text" (which, as explained above, does not mean that filter 78 is a high pass filter or that it operates to sharpen the image).

All of the filter coefficients disclosed in Lin define smoothing kernels that operate to smooth the image. Accordingly, the Examiner's position that filters 78 and 86 of Lin define a high pass filter is incorrect.

Fourth, the Examiner's defining of one of the filters of Lin relative to the other filter of Lin is improper. Throughout the Examiner's Answer, the Examiner takes the position that any kernel that sharpens relative to a kernel that smooths is a sharpening kernel. Such an interpretation of the recited terms "smoothing kernel" and "sharpening kernel" is improper because it completely ignores the established meanings of these terms in the art, or at the least, how these terms are used in the present application.

The definitions of "smoothing kernel" and "sharpening kernel" have been explained in detail in Appellant's Brief. It is improper to identify one as a "smoothing kernel" and the other as a "sharpening kernel" just because one kernel smooths the image to a greater degree than the other smooths the image. As explained in Appellant's Brief, this is analogous to defining "positive" versus "negative" integers. The determination of whether an integer is "positive" or "negative" is made independently for each integer based on the value of the integer relative to zero. Given two integers that are both less than zero, it is improper to identify one as a "negative integer" and the other as a "positive integer" just because one integer is more negative than the other. Likewise, the Examiner is incorrect to identify any kernel that sharpens relative to a kernel that smooths as a sharpening kernel.

Further, the Examiner asserts that the coefficients of filter 78 define a "sharpening kernel" in the context of Lin when these coefficients are compared to the coefficients of filter 72. However, by using the Examiner's relative definitions for smoothing and sharpening kernels, then if filter 72 of Lin were to be altered to have coefficients of "1/15, 2/15, 9/15, 2/15, 1/15", then under the Examiner's own definition the coefficients of filter 78 would define a "smoothing

kernel" because they smooth more than the new coefficients for filter 72. The same kernel cannot possibly be defined as a "smoothing kernel" when used alongside kernel A and a "sharpening kernel" when used alongside kernel B.

This situation becomes even worse if the filters of Lin were to be altered such that filter 78 keeps the same kernel, filter 72 smooths more than filter 78, and filter 78 smooths more than filter 86. In such a situation, how would the Examiner's relative definition scheme operate when filter 78 smooths more than 86 but at the same time filter 78 sharpens more than filter 72? How would the coefficients of filter 78 be defined by the Examiner in this situation. While the coefficients of filter 78 would have the same effect on the image regardless of the other filters used in the system, the Examiner would define this same set of coefficients differently in different situations. Such defining of a kernel relative to other kernels in a system is incorrect and unworkable.

Appellant completely fails to understand why the Examiner continues to insist that one of the filters in the device of Lin is a high pass filter based on his own definition, when this goes against the actual teaching of Lin, goes against the effects that the filters would clearly produce, and goes against the well-known meanings of the terms "smoothing" and "sharpening". Both sets of coefficients used in Lin operate to smooth an image by making the target pixel more like its neighbors through averaging. While the two sets of coefficients used in Lin are different so as to smooth the image to different degrees, each is clearly operates to smooth the image and it is improper to define one as a "smoothing kernel" and the other as a "sharpening kernel". Lin teaches scaling all portions of the source image using low pass filters that use "smoothing convolution kernels" to smooth the image, and does not teach or suggest a method or device for scaling an image using a filter that uses a sharpening kernel. Therefore, the independent claims are patentable over the Lin reference.

THE DEPENDENT CLAIMS ARE PATENTABLE OVER LIN AND MIYAKE

As discussed above, the independent claims are patentable over the Lin reference. Furthermore, the claimed features of the present invention are not realized even if the teachings of the Miyake reference are incorporated into Lin. Miyake does not teach or suggest the claimed features of the present invention that are absent from Lin. Thus, the independent claims distinguish over the Lin and Miyake references, and thus, the dependent claims also distinguish over the Lin and Miyake references.

CONCLUSION

In view of the foregoing, it is respectfully submitted that the application and all of the pending claims are in condition for allowance. Reversal of the final rejection of claims 3, 5-10, 12-16, 18-22, 24, and 25 is respectfully requested.

Respectfully submitted,

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